CLAIMS

What is claimed is:

1. A solar device comprising:

a substrate;

a multijunction solar cell structure having at least a first, second, and third subcells disposed over the substrate;

a lateral conduction layer deposited over at least a portion of the multijunction solar cell structure; and

a bypass diode having a p-type, i-type, and n-type layers, deposited over the lateral conduction layer.

2. The solar device of claim 1, further comprising a well in the multijunction solar cell structure to provide electrical separation between the subcells and the bypass diode.

3. The solar device of claim 2, further comprising a shunt having a first and second contacting ends, wherein the first contacting end of the shunt is connected the lateral conduction layer and the second contacting end of the shunt is connected to the substrate via the well.

4. The solar device of claim 1, further comprising a stop etch layer deposited over the lateral conduction layer.

5. The solar device of claim 1, further comprising a first and second contact layers, wherein the first contact layer is deposited adjacent the bypass diode and the second contact layer is disposed adjacent the substrate.

6. The solar device of claim 1, wherein the substrate is a germanium ("Ge") substrate.

7. The solar device of claim 6, wherein the multijunction solar cell structure is a triple junction solar cell.

8. The solar device of claim 7, wherein the first subcell is a bottom solar cell, the second subcell is a middle solar cell, and the third subcell is a top solar cell.

9. The solar device of claim 8, wherein the bottom solar cell further includes:

a p-doped Ge base layer deposited over the Ge substrate;

an n-doped Ge emitter layer deposited or formed by diffusion over the base layer; and

an n-doped nucleation layer deposited over the emitter layer.

10. The solar device of claim 9, wherein the middle solar cell further includes:

a p-doped back surface field ("BSF") layer deposited over the bottom solar cell;

a p-doped gallium arsenic ("GaAs") base layer deposited over the BSF layer;

an n-doped GaAs emitter layer deposited over the base layer; and

an n-doped indium gallium phosphide$_2$ ("$InGaP_2$") window layer deposited over the emitter layer.

11. The solar device of claim 10, wherein the top solar cell further includes:

a p-doped indium gallium aluminum phosphide ("InGaAlP") back surface field ("BSF") layer deposited over the middle solar cell;

a p-doped $GaInP_2$ base layer deposited over the InGaAlP BSF layer;

an n-doped $GaInP_2$ emitter layer deposited over the $InGaP_2$ base layer; and

an n-doped aluminum indium phosphide$_2$ ("$AlInP_2$") window layer deposited over the $GaInP_2$ emitter layer.

12. The solar device of claim 11, further comprising a n-doped GaAs cap

layer deposited between the top solar cell and the lateral conduction layer.

13. The solar device of claim 12, wherein the lateral conduction layer is an n-doped GaAs layer for conducting electrical current.

14. The solar device of claim 1, wherein the p-type layer of the bypass diode is a p-doped GaAs layer and the n-type layer of the bypass diode is an n-doped GaAs layer.

15. The solar device of claim 14, wherein the i-type layer is a lightly doped GaAs layer for reducing defect breakdown.

16. The solar device of claim 14, wherein the i-type layer is an undoped GaAs layer for reducing defect breakdown.

17. A solar cell structure comprising:

at least one solar cell disposed over a germanium ("Ge") substrate;

a lateral conduction layer deposited over a portion of the solar cell structure;

a bypass diode deposited over the lateral conduction layer; and

a shunt having a first and second contacting sides formed between the solar cell and the bypass diode, wherein the first contacting side of the shunt is connected to the substrate and the second contacting side of the shunt is connected to the lateral conduction layer.

18. The solar cell structure of claim 17, further comprising a well situated between the solar cell and the bypass diode, wherein the well provides electrical separation between the solar cell and the diode.

19. The solar cell structure of claim 18, further comprising a stop etch layer

deposited over the lateral conduction layer.

20. The solar cell structure of claim 19, further comprising a first and second contact layers, wherein the first contact layer is deposited over the bypass diode and the second contact layer is disposed over the substrate.

21. The solar cell structure of claim 17, wherein the solar cell contains a bottom, middle, and top subcells.

22. The solar cell structure of claim 21, wherein the bottom subcell further includes:

a Ge base layer deposited over the substrate;

a Ge emitter layer deposited or formed by diffusion over the base layer; and

a nucleation layer deposited over the emitter layer.

23. The solar cell structure of claim 22, wherein the middle subcell further includes:

a back surface field ("BSF") layer deposited over the bottom solar cell;

a gallium arsenic ("GaAs") base layer deposited over the BSF layer;

a GaAs emitter layer deposited over the base layer; and

an indium gallium phosphide$_2$ ("$InGaP_2$") window layer deposited over the emitter layer.

24. The solar cell structure of claim 23, wherein the top subcell further includes:

an indium gallium aluminum phosphide ("InGaAlP") back surface field ("BSF") layer deposited over the middle solar cell;

a $GaInP_2$ base layer deposited over the InGaAlP BSF layer;

a $GaInP_2$ emitter layer deposited over the $InGaP_2$ base layer; and

an aluminum indium phosphide$_2$ ("AlInP$_2$") window layer deposited over the GaInP$_2$ emitter layer.

25. The solar cell structure of claim 24, further comprising a GaAs cap layer deposited between the top subcell and the lateral conduction layer.

26. The solar cell structure of claim 17, wherein the lateral conduction layer is an GaAs layer for transporting electrical current.

27. The solar cell structure of claim 17, wherein the bypass diode further includes an n-doped GaAs layer deposited over the lateral conduction layer and a p-doped GaAs layer deposited over the n-doped GaAs layer of the bypass diode.

28. The solar cell structure of claim 17, wherein the bypass diode further includes a p-doped GaAs layer deposited over the lateral conduction layer and an n-doped GaAs layer deposited over the p-doped GaAs layer of the bypass diode.

29. The solar cell structure of claim 28, wherein the bypass diode further includes an i-type layer, which is a lightly n-doped GaAs layer and deposited between the n-doped GaAs layer of the bypass diode and the p-doped GaAs layer of the bypass diode, for reducing defect breakdown.

30. The solar cell structure of claim 28, wherein the bypass diode further includes an i-type layer, which is an undoped GaAs layer and deposited between the n-doped GaAs layer of the bypass diode and the p-doped GaAs layer of the bypass diode, for reducing defect breakdown.

31. A method for manufacturing a solar device comprising:

depositing a germanium ("Ge") substrate;

depositing a solar cell having multiple junctions on the Ge substrate;

depositing a lateral conduction layer on the solar cell;

depositing a bypass diode over the lateral conduction layer;

etching a well between the bypass diode and the solar cell; and

depositing a shunt between the Ge substrate and the bypass diode through the well, wherein one side of the shunt is connected to the Ge substrate and another side of the shunt is connected to the lateral conduction layer.

32. The method of claim 31, further comprising depositing a stop etch layer between the lateral conduction layer and the bypass diode.

33. The method of claim 31, further comprising:

depositing a first metal layer on the bypass diode for contact pad; and

depositing a second metal layer on the Ge substrate for contact pad.

34. The method of claim 31, wherein depositing a bypass diode further including:

depositing a n-doped gallium arsenic ("GaAs") base layer over the stop etch layer;

depositing a i-doped GaAs layer over the n-doped GaAs base layer; and

depositing a p-doped GaAs emitter layer over the i-doped GaAs layer.

35. The method of claim 31, wherein depositing a solar cell further includes:

depositing a Ge-type bottom subcell including a nucleation layer;

depositing a GaAs-type middle subcell over the bottom subcell; and

depositing a $GaInP_2$-type top subcell over the middle subcell.

36. The method of claim 35, further comprising depositing a GaAs cap layer between the top subcell and the lateral conduction layer.